dimerous. The placentæ, accordingly, are only two. The groove on the stigma and the placentæ are in line with the fertile stamens.

Here, therefore, is a symmetrical and complete, regular but dimerous orchideous flower, the first verticil of stamens not antheriferous, the second antheriferous, the carpels alternate with these; and here we have clear (and perhaps the first direct) demonstration that the orchideous type of flower has two stamineal verticils, as Brown always insisted.—*Silliman's Journal*, September 1866.

Boussingault's Researches on the Action of Foliage.

A full abstract of the first part of these investigations, communicated to the French Academy of Sciences, is given in the 'Comptes Rendus,' vol. lx. no. 18 (May 1865). Theodore Saussure had long ago ascertained that, while plants prosper and decompose carbonic acid gas in an atmosphere containing as much as one-twelfth or even one-eighth part of that gas, they promptly perish in unmixed carbonic acid, apparently without decomposing any of it. Boussingault made his experiments in a better form, upon leaves only, avoiding all complication of the action of the roots or other parts of the plant. His results are:—

1. That leaves exposed to sunshine in pure carbonic acid do not decompose this gas at all, or only with extreme slowness.

2. But in a mixture with atmospheric air, they decompose carbonic acid rapidly. The oxygen of the atmospheric air, however, appears to play no part.

3. Leaves decompose carbonic acid in sunshine as readily when this gas is mixed with nitrogen or with hydrogen.

Although this decomposition of carbonic acid by green foliage must be a case of dissociation—a separation of carbon from oxygen—yet Boussingault recognizes an analogy here with an opposite phenomenon, viz. with the slow combustion of phosphorus at the ordinary temperature. Phosphorus in pure oxygen emits no light, does not sensibly undergo combustion, but does so in a mixture of oxygen with atmospheric air, or with nitrogen, hydrogen, or carbonic acid. The analogy may even be carried further; for while a stick of phosphorus is not phosphorescent in pure oxygen at ordinary or increased pressure, it becomes so in rarified oxygen. And Boussingault equally ascertained that leaves which exerted no sensible action upon pure carbonic acid at ordinary pressure, decomposed it, with the liberation of oxygen gas, under diminished pressure. That is, rarefaction and mixture with an inert gas act alike in mechanically separating the atoms, whether of carbonic acid, as in the one case, or of oxygen, as in the other, so as to determine the action either of combination or of dissociation.

In a continuation of these investigations (Comptes Rendus, vol. lxi., Sept. 25, 1865), Boussingault shows that carbonic oxide, whether pure or diluted, is not decomposable by foliage, and that this inertness of green foliage upon carbonic oxide goes to confirm the opinion maintained in his 'Economie Rurale,' that leaves simultaneously decompose carbonic acid and water, CO^2, $HO=CO, H, O^2$: the O^2 being liberated, CO, H expresses the relation under which carbon is united with the elements of water in cellulose, starch, sugar, &c., *i. e.* in the important principles elaborated by the leaves, the composition of which is represented by carbon and water. He goes on to prove that a leaf which has been decomposing carbonic acid and water all day long is capable of doing the same work the next day, if not allowed to dry; but the losing of a certain amount of water annihilates this faculty, and irremediably destroys the life of the cells of a leaf, vegetable life in this state being far less tenacious than that of some of the lower animals (Tardigrades, *Notipes*, &c.), which bear wonderful desiccation.

The third instalment of the investigation is given in Nos. 16 and 17 of the same volume (Oct. 16 and 23, 1865). It appears that detached leaves, kept in shade for many days, with the cut end of the petiole in water to prevent desiccation, preserve the power of decomposing carbonic acid whenever brought into sunshine. But for this they must be kept in an atmosphere containing a supply of oxygen; without this they soon die, as Boussingault thinks, from asphyxia. This oxygen in darkness is slowly transformed into carbonic acid, through an operation which is presumed to go on continually, whether in light or darkness, and to answer to respiration. Of course a healthy and active leaf decomposes far more carbonic acid in the light than it forms in darkness. In eighteen experiments with oleander-leaves exposed to the sun from 8 A.M. to 5 P.M. in an atmosphere rich in carbonic acid, a square metre of foliage decomposed on the average over a litre of carbonic acid per hour, while in darkness only $\frac{7}{100}$ of a litre of carbonic acid was produced per hour. In air which contains oxygen and carbonic acid, leaves will go on indefinitely producing oxygen in the presence of carbonic acid, and carbonic acid in the presence of oxygen. But the latter, though relatively small in amount, seems to be necessary to the preservation of their vitality. In hydrogen, carburetted hydrogen, or nitrogen, as well as in pure carbonic acid, they soon lose their decomposing power, and die from the impossibility of respiration, *i. e.* are asphyxiated.

Leaves confined in a limited portion of atmospheric or other air over mercury lose the power of decomposing carbonic acid; and the experiments pretty clearly show that they lose it through the deleterious action of the vapour of mercury. It is thought remarkable that the leaf does not under these circumstances at all lose the power of transforming oxygen into carbonic acid; but that is what we should expect; for the carbonic acid so evolved (whether its evolution be called respiration or not) must be a product of decomposition of the leaf's contents or substance.

We owe to Boussingault and his assistant Lewy the idea of determining the composition of the air contained in a fertile soil, and the fact that this air in a strongly manured soil contains a very large percentage of carbonic acid. Boussingault has now devised an experiment by which the air contained in a branch of an oleander in full vegetation was extracted. It proved to be, nitrogen 88·01 per cent., oxygen 6·64 per cent., carbonic acid 5·35 per cent., being about the composition of the air from a well-manured soil. This carbonic acid carried into the leaves with the sap, and also that which they may absorb directly from the atmosphere, decomposed along with water under sunlight, must be the source of the glucose ($C^{12} H^{12} O^{12}$) which it is the principal function of foliage to produce. This glucose, in fixing or abandoning the elements of water, becomes sugar, starch, cellulose, or other hydrates of carbon, which, in whatever part of the plant accumulated or deposited, and however transformed or retransformed, must always have originated from carbonic acid and water in the green parts of plants. In closing his present paper with some illustrations of this now familiar view, Boussingault announces that his more recent experiments will enable him to demonstrate the direct formation of saccharine matter by the green parts of vegetables exposed to the light.—Silliman's *American Journal*, July 1866.

Observations on a Malady of the Cotton-plant, called "Pelagra," and on some Fungi which accompany it. By G. Gasparrini.

In the summer of 1863 some cotton-plants cultivated in the province of Naples were attacked by a disease which alarmed the cultivators, who have become frightened about the attacks of Mucedineæ, in consequence of the ravages of *Oïdium*. The author examined the blackened stems of the plants attacked, and detected several Fungi of the family Mucedineæ—amongst others *Alternaria tenuis*. This production did not appear to him to be autonomous, but one of the conidic forms of a small fungus of higher order, namely *Pleospora* (*Sphæria*) *herbacea*. He regards *Penicillium glaucum* as a gonidic form of *Alternaria*. These, however, are pure hypotheses.

M. Gasparrini does not attribute the disease of the cotton-plant to these plants, but considers it to be due to meteorological conditions.—*Bibl. Univ.* 1866, *Bull. Sci.* p. 167.

Fossil Medusæ.

Professor Haeckel of Jena, who in 1865 called attention to the existence of well-preserved Medusæ in the lithographic slates of Eichstadt, belonging probably to the families of Æquoridæ and Trachynemidæ, has published, in a recent number of 'Leonhard und Geinitz's Jahrbuch,' a second notice of two other species of Medusæ so well preserved that the family to which they belong can be ascertained beyond doubt. They are from the same locality, and belong to the Discophoræ, to the family of Rhizostemidæ. The restoration which Professor Haeckel has been able to make from the specimens in his possession is quite satisfactory; and the attention of geologists having been called to this subject, we may expect further interesting developments in the history of Acalephæ, since it is now well known that even at the present time a kind of petrifaction of jellyfishes, when thrown upon sandy beaches, readily takes place.—Silliman's *American Journal*, July 1866.